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EXAMINER

LAVARIAS, ARNEL C

ART UNIT	PAPER NUMBER
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2872

DATE MAILED: 06/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/605,319

Applicant(s)

GRIER ET AL.

Examiner

Arnel C. Lavarias

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 September 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 9/22/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. The Examiner notes that the pending claims in the instant application are drawn to methods of manipulating particles including a manufacturing process, as set forth in the original restriction requirement of Paper No. 4, dated 3/8/01, of parent case 09/495064. It is noted that all the pending claims are drawn to the above methods, and hence will be examined.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference character(s) mentioned in the description:

Figure 5- Reference numeral 62

Figure 6- Reference numeral 66.

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

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3. Figures 1 and 2 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities:
- Paragraph 0001, line 3- insert '(U.S. Patent No. 6,624,940; issued September 23, 2003)' after '2000,'
- Paragraph 0050, line 15- 'slide,' should read 'slide.'.
- Appropriate correction is required.
5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required:
- Claims 11 and 22- the drawings and the specification of the disclosure fails to show or recite the diffractive optical element being positioned in the back focal plane of the focusing element.

Double Patenting

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

7. Claims 1-8, 10-19, and 21-22 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-49 of U.S. Patent No. 6055106, of record. Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 6055106 similarly discloses a method for manipulating a plurality of particles by forming and moving a plurality of optical traps (See for example Claims 1, 17, 23, 25, 41), the method comprising providing at least one laser beam from at least one source (See Claim 23, line 3); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See Claim 23, lines 4-6); establishing an optical gradient for each of the plurality of separate laser beams to form a plurality of separate optical traps for trapping and/or moving the plurality of particles (See Claim 23, lines 7-9; Claim 24); and performing a manufacturing process which changes the position of at least one of the plurality of

particles (See Claim 23, lines 7-9). U.S. Patent No. 6055106 also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See Claim 23, lines 7-9); the diffraction means comprising a time addressable phase-shifting medium (See Claims 1, 13, 25, 36, 37, 38); the step of moving the plurality of particles comprising the step of dynamically changing locations of at least one of the plurality of optical traps (See Claims 1, 11, 12, 25, 28, 36, 37, 41, 43, 46); applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location (See Claims 1, 5, 17, 20, 25, 30); moving the plurality of particles by translating at least one of laterally and axially the optical traps relative to an optical axis (See Claims 17, 19); the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See Claims 1, 4, 17, 21, 25, 29); converging selected ones of the laser beams and forming the optical traps at spatial locations either in the focal plane or out of a focal plane of an objective lens (See Claims 1, 10, 25, 35, 41, 45); the performing of the manufacturing process comprises the step of moving the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element (See Claims 41, 47); and the method including a focusing element and the diffractive element being positioned in the back focal plane of the focusing element (See Claims 1, 9, 25, 34, 41, 44).

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8. Claims 9 and 20 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-49 of U.S. Patent No. 6055106 in view of Ashkin et al. (U.S. Patent No. 4893886), of record.

U.S. Patent No. 6055106 similarly discloses the recited invention as set forth above, except for moving the plurality of particles by moving a sample stage relative to a specimen comprising the trapped particles. However, Ashkin et al. teaches a non-destructive optical trap apparatus (See for example Figures 1-2) for manipulating biological particles, wherein the sample stage or mount (See 26 in Figure 1; Figures 3-5) is movable to provide movement of the particles. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to move the particles by moving the sample mount or stage to provide increased movement range for the particles.

9. Claims 1-2, 7, 12-13, 18 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-18 of U.S. Patent No. 6416190. Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 6416190 similarly discloses a method for manipulating a plurality of particles by forming and moving a plurality of optical traps (See for example Claims 1, 8, 13, 18), the method comprising providing at least one laser beam from at least one source (See Claim 1, lines 2-5); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See Claim 1, lines 13-16; Claim 6); establishing an optical gradient for each of the plurality of separate laser beams to form a

plurality of separate optical traps for trapping and/or moving the plurality of particles (See Claim 1, lines 3-16); and performing a manufacturing process which changes the position of at least one of the plurality of particles (See Claim 1, lines 13-21; Claim 8, 9, 13, 17). U.S. Patent No. 6416190 also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See Claim 1, lines 13-21; Claim 8, 9, 13, 17); and the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See Claims 1, 8, 13, 18).

10. Claims 1-2, 7, 12-13, 18 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-25 of U.S. Patent No. 6626546. Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 6626546 similarly discloses a method for manipulating a plurality of particles by forming and moving a plurality of optical traps (See for example Claims 1, 4, 5, 8, 9, 16, 21), the method comprising providing at least one laser beam from at least one source (See Claim 1, lines 2-3); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See Claim 1, lines 6-7); establishing an optical gradient for each of the plurality of separate laser beams to form a plurality of separate optical traps for trapping and/or moving the plurality of particles (See Claim 1, lines 8-9); and performing a manufacturing process which changes the position of at least one of the plurality of particles (See Claim 1, lines 8-9;). U.S. Patent No. 6626546 also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See Claims 1, 4, 5, 8, 9, 16, 17, 21);

and the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See Claims 1, 4, 5, 8, 9, 16, 21).

11. Claims 1-4, 7, 12-15, 18 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-24 of U.S. Patent No. 6737634. Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 6737634 similarly discloses a method for manipulating a plurality of particles by forming and moving a plurality of optical traps (See for example Claims 1, 11, 16, 21), the method comprising providing at least one laser beam from at least one source (See Claim 1, lines 2-3); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See Claim 1, lines 4-5; Claim 2); establishing an optical gradient for each of the plurality of separate laser beams to form a plurality of separate optical traps for trapping and/or moving the plurality of particles (See Claim 1, lines 4-10; Claims 2-5); and performing a manufacturing process which changes the position of at least one of the plurality of particles (See Claim 1, lines 4-10; Claims 2-5). U.S. Patent No. 6737634 also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See Claim 1, lines 4-10; Claims 2-5); the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See Claims 1, lines 4-5); the diffraction means comprising a time addressable phase-shifting medium (See Claims 1-6, 10); the step of moving the plurality of particles comprising the step of dynamically changing locations of at least one of the plurality of optical traps (See Claims 1-5).

12. Claims 1-2, 7, 12-13, 18 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-10 of copending Application No. 10/210519 (U.S. Patent Application Publication US2004/0021949). Although the conflicting claims are not identical, they are not patentably distinct from each other because copending Application No. 10/210519 (U.S. Patent Application Publication US2004/0021949) similarly discloses a method for manipulating a plurality of particles by forming and moving a plurality of optical traps (See for example Claims 1, 8, 9), the method comprising providing at least one laser beam from at least one source (See Claim 1, lines 4-6); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See Claim 1, lines 4-6); establishing an optical gradient for each of the plurality of separate laser beams to form a plurality of separate optical traps for trapping and/or moving the plurality of particles (See Claim 1, lines 4-14); and performing a manufacturing process which changes the position of at least one of the plurality of particles (See Claim 1, lines 20-21). Copending Application No. 10/210519 (U.S. Patent Application Publication US2004/0021949) also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See Claims 1, See Claim 1, lines 20-21); and the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See Claim 1, lines 7-14).

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

14. Claims 1-2, 4, 6-9, 12-13, 15, and 17-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Neal (U.S. Patent No. 5939716).

Neal discloses a method for manipulating a plurality of particles by forming and moving a plurality of optical traps (See for example Figure 4, 6), the method comprising providing at least one laser beam from at least one source (See 26 in Figure 4); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See 18 in Figure 4); establishing an optical gradient for each of the plurality of separate laser beams to form a plurality of separate optical traps for trapping and/or moving the plurality of particles (See col. 5, line 50-col. 6, line 36); and performing a manufacturing process which changes the position of at least one of the plurality of particles (See col. 8, lines 7-40). Neal also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See col. 8, lines 7-40); the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See 24 in Figure 4); the step of moving the plurality of particles comprising the step of dynamically

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changing locations of at least one of the plurality of optical traps (See col. 2, line 49-col. 3, line 8); moving the plurality of particles by translating at least one of laterally and axially the optical traps relative to an optical axis (See col. 2, line 49-col. 3, line 8); converging selected ones of the laser beams and forming the optical traps at spatial locations either in the focal plane or out of a focal plane of an objective lens (See 18, 24, 28 in Figure 4); moving the plurality of particles by moving a sample stage relative to a specimen comprising the trapped particles (See col. 2, line 49-col. 3, line 8); and at least one focusing element (See for example 36, 24 in Figure 4; Objective with Z-drive in Figure 6).

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claims 3 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Long (U.S. Patent No. 5986781).

Neal discloses the invention as set forth above in Claims 1 and 12, except for the diffraction means being a time-addressable phase-shifting medium. However, as is known in the art, diffractive optical elements may be implemented utilizing liquid crystal spatial light modulators (SLM) or displays. For example, Long et al. teaches a liquid

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crystal display (See for example 68 in Figure 1) which dynamically received computer-generated data and displays such data (See entire document, especially Abstract). Each data corresponds to an optical characteristic, such as an amplitude or phase, to be applied to the incident light. Further, the SLM may be addressed in real time. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the diffraction means be a time-addressable phase-shifting medium, as taught by Long, in the method for manipulating a plurality of particles of Neal, to provide continuous, real-time adjustments to the optical characteristics of the diffraction optical element.

17. Claims 5 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Sasaki et al. (K. Sasaki, M. Koshioka, H. Misawa, N. Kitamura, H. Masuhara, 'Pattern formation and flow control of fine particles by laser-scanning micromanipulation', Opt. Lett., vol. 16, no. 19, October 1, 1991, pp. 1463-1465.).

Neal discloses the invention as set forth above in Claims 1 and 12, except for the step of applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location. However, the use of such transfer optical elements, such as relay optics and telescope optics are known in the art of microscopy. For example, Sasaki et al. teaches a laser scanning micromanipulation microscope apparatus based on optical trapping technique (See for example Figure 1), wherein a telescope or relay optical system (See L1, L2 in Figure 1) is utilized in the beam path. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the method

of Neal include the step of applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location, as taught by Sasaki et al., for the purpose of providing beam diameter matching and image relaying capabilities.

18. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Sasaki et al.

Neal discloses the invention as set forth above in Claims 1 and 12, except wherein the performing the manufacturing process comprises the step of moving the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element. However, as is well known, the use and optical placement of scanning mirrors, particularly when used in conjunction with telescopic relay lenses and objective lenses in a microscope system, are known in the art. For example, as stated above, Sasaki et al. teaches a laser scanning micromanipulation microscope apparatus based on optical trapping technique (See for example Figure 1), wherein a telescope or relay optical system (See L1, L2 in Figure 1) is utilized in the beam path. Further, Sasaki et al. teaches the use of one or more scanning (galvano) mirrors to provide beam scanning and hence optical trap movement. The scanning mirror (See in particular the second galvano mirror in the beam path in Figure 1), the telescopic relay lenses (See L1, L2 in Figure 1), and the objective (See OL in Figure 1) are configured in such a way that the scanning mirror is disposed at a point conjugate to a back aperture of the objective. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was

made to have the manufacturing process step of the method of Neal further include the step of moving the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element, as taught by Sasaki et al., to impart a slight driving force to the trapped particles, thus allowing for movement and manipulation of the particles.

19. Claims 11 and 22, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal.

Neal discloses the invention as set forth above in Claims 1 and 12, except for the diffractive optical element specifically being positioned in the back focal plane of the focusing element. However, the location of placement of the diffractive optical element behind/prior to the focusing element provides adjustment of the locations of the optical traps (See 12 in Figure 4) in the focal plane (See 28 in Figure 4) of the focusing lens (See 24 in Figure 4). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the diffractive optical element be positioned, for example, in the back focal plane of the focusing element, to provide additional separation between the optical traps in the focal plane of the optical traps.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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E. R. Dufresne, D. G. Grier, 'Optical tweezer arrays and optical substrates created with diffractive optics', Rev. Sci. Instru., vol. 69, no. 5, May 1998, pp. 1974-1977 to Dufresne et al.

Dufresne et al. is being cited to evidence the apparatus and method for forming and positioning optical traps/tweezers (See for example Figure 1), similar to the recited invention. It is noted, however, that Dufresne et al. is not available as prior art against the instant application.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arnel C. Lavarias whose telephone number is 571-272-2315. The examiner can normally be reached on M-F 8:30 AM - 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Arnel C. Lavarias

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6/4/04



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GROUP 2800**